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Studies on Equilibrium Moisture Content of Canned Prawn with Particular Reference to Drained Weight

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Drained weight of canned prawn depends on moisture content of blanched meat and equilibrium moisture (EM) content of processed meat. The greater the difference between the two values the more is the fluctuation in drained weight. EM is a fixed value with particular reference to the species of prawn, which has been justified mathematically and by material balance of can contents before and after processing.

Fluctuation in drained weight of canned prawn is quite common in India. To avoid the chance of rejection due to under weight, canneries usually add extra amount of meat on an arbitrary basis in each can. Existing rules do not limit excess weight in cans over the declared one. The export of canned prawn has contributed only 0.4% of our foreign exchange earning through shrimp in 1977. However, India has exported in certain years more than 2000 tonnes of canned prawn. Considering on an average ten grammes of extra meat per can of 301 x 206 size, the losses are equivalent to about 600 tonnes of fresh prawn per annum.

The usual practice of adding extra amount of meat can be avoided by adopting the standard blanching technique (Chaudhuri & Balachandran, 1965). In practice, the processing conditions, particularly the concentration of blanching brine and exact time of blanching, are liable to vary unless strict quality control measures are adopted. Varma *et al.* (1969) tried to find out the factors responsible for fluctuations in drained weight of canned prawns and suggested a method for rectifying the same. It is possible to explain the variations of drained weight by moisture content of blanched meat and moisture content of meat after thermal processing (equilibrium moisture), but no quantitative proof has been given so far. Explanation given by Govindan (1975) is not satisfactory. The present paper reports an attempt of the authors to study the equilibrium moisture content of canned prawns with reference to drained weight.

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Materials and Methods

The species of prawn employed in the study was *Metapenaeus monoceros* of 8–10 cm size. The specification used for the standard pack of prawn was that of Varma *et al.* (1969) Chemical analyses were carried out according to the methods of AOAC (1965).

Results and Discussion

Experiments were performed to note the variations of drained weights in canned prawns with particular reference to the moisture content of blanched meat prepared by blanching in different concentrations of brine (5%, 7%, 10%, 15%) for different interval of time. In each case when graphs were drawn taking fluctuation of drained weight (W) as ordinate and moisture content of blanched meat, expressed as g of water/g of dry solid (M) as abscissa, straight lines were obtained as represented in Fig. 1. All the straight lines however pass through the point 2.62, namely, 72.4% moisture (on wet basis) supporting the concept that the equilibrium moisture content (EM) of canned prawn, is a fixed value with particular reference to the species and experimental conditions. EM content of any particular species of prawn under identical condition of processing can never show variations by 1%, that is, 72.51% and 71.50% as reported in Table 3, Expt. 1 and 2 of Govindan (1975).

Table 1. *Analysis and material balance of can contents*

Experiment	Blanched meat Moisture %	Blanched meat Salt %	Cut out test Drained weight g	Cut out test Salt %	Filled liquor Volume ml	Filled liquor Concentration of brine g/100 ml	Filled liquor Equilibrium moisture %	Filled liquor Total soluble solid % DWB	Material Balance Before canning Total solid g	Material Balance Before canning Salt g	Material Balance After canning Total solid g	Material Balance After canning Salt g
I	72.97	1.467	136.0	1.612	86.0	2.661	72.4	3.78	40.79	4.483	40.78	4.482
II	70.10	2.393	152.0	2.084	70.0	3.756	72.4	4.14	44.86	5.798	44.85	5.796
III	69.10	2.498	156.0	1.854	66.0	4.624	72.4	4.90	46.28	5.947	46.28	5.944
IV	71.24	2.041	130.6	2.046	87.4	3.020	72.4	3.98	39.51	5.312	39.51	5.310
** V	74.25	2.403	124.1	4.200	184.0	1.774	72.4	2.23	38.36	8.475	38.352	8.476
**VI	72.00	3.752	94.5	5.320	205.5	2.260	72.4	2.63	31.50	9.676	31.499	9.679

Condition of packing I– III 142 g blanched meat + 80 ml of 3.0% brine
IV 128 g blanched meat + 90 ml of 3.0% brine
V 128 g blanched meat + 180 ml of 3.0% brine*
VI 90 g blanched meat + 210 ml of 3.0% brine*

Example of workings I– A. Total solid = Prawn meat dry solid + salt
a) Before canning 142 x 0.2703 + 80 x 0.03 = 40.79
b) After canning 136 x 0.276 + 86 x 0.0378 = 40.78
B. Salt balance = Salt in meat + salt in brine
c) Before canning 142 x 0.01467 + 80 x 0.03 = 4.483
d) After canning 136 x 0.01612 + 86 x 0.02661 = 4.482

* Experiments conducted using 500 ml conical flask in place of cans

** Irregular pack

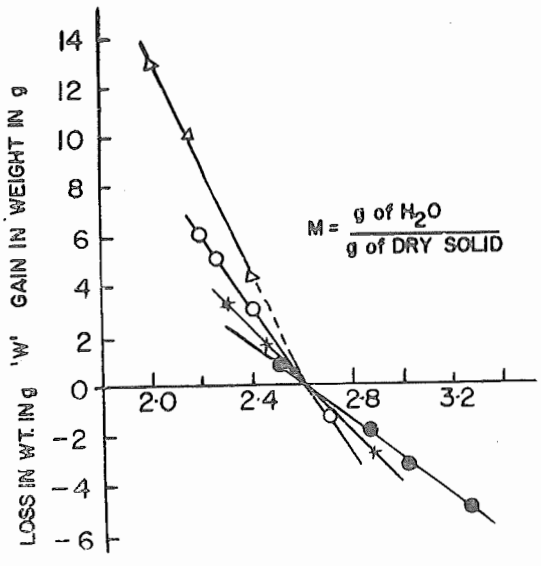

Fig. 1. *Plot of 'W' Vs 'M'*
Blanching brime concentration
●—● 5%; X—X 7%;
O—O 10%; △—△ 15%

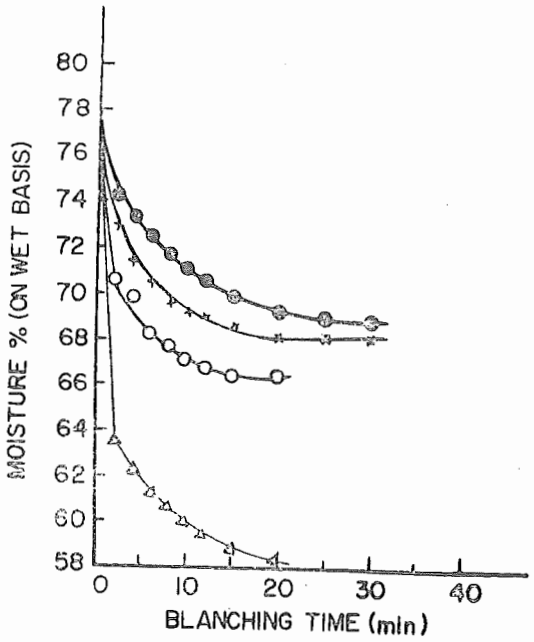

Fig. 2. *Plot of moisture % Vs time*
●—● 7%; X—X 10%;
O—O 15%; ▷—◁ 25%

Table 2. *Material balance of can contents*

Source* (Table 8)	Total solid before canning A	Balance after canning B	% Error $\frac{B-A}{A} \times 100$
Exp. No. 1 (i)	37.20	38.125	+2.486
–do– (ii)	37.93	39.970	+5.379
–do– (iii)	39.49	41.515	+5.129
–do– (iv)	41.09	42.452	+3.207
Exp. No. 4 (iii)	49.01	52.290	+6.692
–do– (iv)	60.01	61.386	+2.293

Examples of workings

Exp. No. 1 (i) Total solid balance

(a) Before canning $142 \times 0.2440 + 85 \times 0.03 = 37.20$

(b) After canning $125 \times 0.2554 + 97 \times 0.064 = 38.125$

*Data from Govindan (1975)

The concept of EM may be justified further from the material balance of can contents before and after processing with particular reference to total solid and salt contents. Table 1 shows the material balance of can contents both for standard packs and unconventional packs of prawn, canned in brine. Good agreement between the values was noticed. However, the material balance (Table 2) calculated from Govindan's data (1975) shows variations in the range of + 2.486% to + 6.692% on dry weight basis, that is, 7.25% to 15.68% on wet weight basis. As the drained weight of the can is noted in wet weight basis, the variation of 7.25 to 15.68% would mean a fluctuation of 10.29 to 22.26 g/can of 142 g which is appreciable. In the examples cited (Govindan, 1975) there was excess material in cut out tests than the material packed in can before processing which is however against the principle of conservation of material.

The moisture content of blanched meat gradually decreases with the increase in time of blanching and with the increase in concentration of blanching brine and finally the moisture content becomes constant (Fig. 2) under the specified condition. However, the rate is dependent upon the quantum of heat received by the meat (Govindan, 1975). Under adverse condition of blanching (25% salt concentration) the moisture content of *M. monoceros* reached a steady value at 58.46% moisture level. However, irrespective of the moisture content of the blanched meat EM content should be in the range of 72.0% to 74.4%, unless the characteristic water holding property of muscle tissue is altered by some chemicals.

References

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